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New records of myxomycetes from the Comoros Islands

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Abstract—In a 2016 study encompassing four different regions and nine different localities on Ngazidja Island, ten myxomycete species were identified representing five genera: *Arcyria* (1 sp.), *Badhamia* (1 sp.), *Diderma* (1 sp.), *Didymium* (4 spp.), and *Physarum* (3 spp.). *Artocarpus heterophyllus*, the most productive substrate plant, yielded four myxomycete species, followed by *Ricinus communis* with two. The study methods and results of this research are outlined and accompanied by notes, comments, and microscopic images for selected species.

Keywords—Afrotropics, Indian Ocean, Mozambique Channel, volcanic

Introduction

The Comoros Islands lie in the Indian Ocean at 10–20°S 40–50°E at the northern entrance of the Mozambique Channel between Mozambique and the northern tip of Madagascar (Central Intelligence Agency 2017). This independent state consists of four volcanic islands—Ngazidja (Grande Comore), Anjouan (Ndzouani), Mayotte (Maoré), and Moheli (Mwali). Geochemical estimates place island formation at 1.4–15 million years ago (mya) for Mayotte, 0.62–2.8 mya for Moheli, 0.4–1.5 mya for Anjouan, and 0.13 mya to the present time for Ngazidja (Bachèlery & al. 2016; Emerick & Duncan 1982, 1983; Esson & al. 1970; Flower 1973; Nougier & al. 1986; Späth & al. 1996).

Ecologically, the Comoros Islands belong in the Afrotropical biogeographic realm and are characterized by very rich biotopes and high biodiversity

(Olson & Dinerstein 2002). Among the few studies of the Comoros flora, the most complete is that of Voeltzkow (1917), who cited 935 vascular plants. Most (84.4%) of the land surface is agricultural and 1.4% is forested (Central Intelligence Agency 2017). Endemic coastal and low elevation vegetation has been almost completely destroyed by anthropogenic effects (e.g., deforestation, agriculture, population density, and exotic species), but the forests seem to be better protected at high elevations (Wikipedia 2017a).

Comoros has a humid tropical climate, with the November–April rainy season followed by dry weather conditions during December–March. Temperatures range between 24 and 28°C, and the annual average precipitation is high (200 cm); due to the monsoon climate effects, there is abundant rain even during the dry season (Capaustral 2017).

Until recently, myxomycetes (traditionally treated as fungi) have been placed in *Eumycetozoa* (the true slime molds); recent molecular data, however, supports them in the *Amoebozoa* (Stephenson 2011). Myxomycetes have not previously been reported from this region (Ndiritu & al. 2009, Ndiritu & de Haan 2014); here we report the first records from Comoros.

Materials & methods

Collection sites—The study area was mainly Ngazidja (11°40′S 43°20′E), the largest and most densely populated (c. 400,000; Wikipedia 2017b) of the Comoros islands (Plate 1). The island covers 1862 km^2, and its elevations range from sea level to 2361 m at the summit of the volcano Karthala (Singaomara 2017). Our study was carried out mainly in five (of twelve) regions—Bambao, Dimani, Hamanvou, Oichili, and Mboudé. The climate of these regions is summarized in Plate 2 and Table 1.

Specimens—During the dry season (September) of 2016, we collected material randomly from five different regions on Ngazidja Island. In each locality, various substrates (aerial litter, ground litter, bark, coarse woody debris, rabbit dung) were placed in paper bags and documented (e.g., material type, dates of collection, locality, geographical coordinates, and elevation). Location coordinates were determined using a Garmino® eTrex Legend® HCx GPS. After placing sterile filter paper in sterile glass Petri dishes, sample material was placed on the bottom and were wetted with distilled water for 24–48 hours for the application of the moist chamber technique as described in Stephenson & Stempen (1994). Moist chamber cultures were prepared with 10 samples of the various substrates. Water was added every few days as required, to maintain the humidity for the entire observation period of up to four weeks. Each day stereomicroscopic (Nikon SM 800) observations and notes were taken; appearance and mature fructifications of myxomycetes were photographed. Then fructifications were pre-treated for slide-coverslip permanent preparations using Hoyer's medium. Light photomicrographs were obtained using

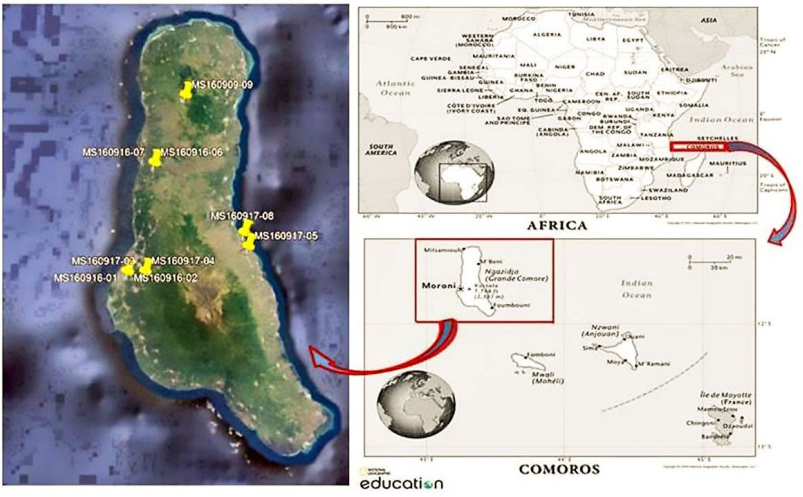

Plate 1. Localities sampled for myxomycetes on Ngazidja (Grand Comore)

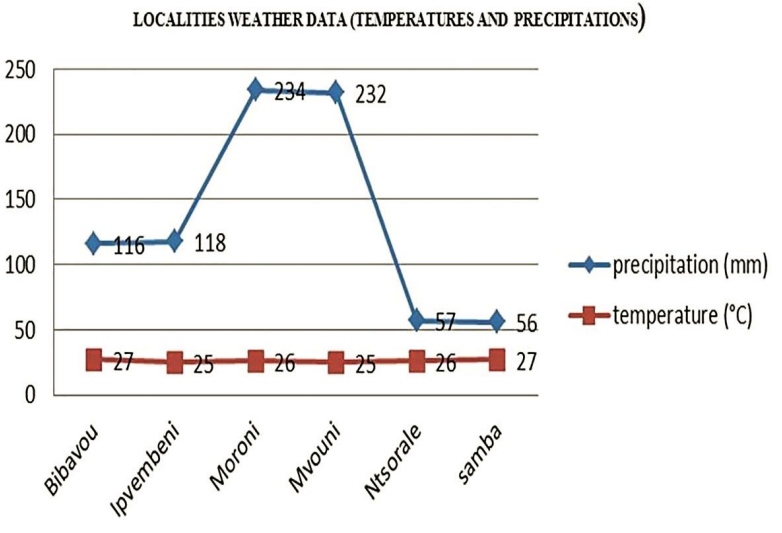

Plate 2. Average annual temperatures and precipitation for Bibavou, Ipvembeni, Moroni, Mvouni, Ntsorale, and Samba

a Nikon DS-Fi 1 microscope equipped with a Nikon Eclipse 50i camera system. Plasmodium, sporangium type, capillitium, peridium, spores, and other descriptive characters were recorded (Plates 3–12). Taxonomic position, nomenclature, and identification of species were determined by utilizing data obtained from stereo- and light-microscopical observations, published references, and internet sources (Ing 1999; Lado & Pando 1997; Lado 2001; Lakhanpal & Mukerji 1981; Farr 1976, 1981; Martin & Alexopoulos 1969; Martin & al. 1983; Nannenga-Bremekamp 1991; Stephenson & Stempen 1994; Thind 1977; Discover Life 2017; Global Biodiversity Information Facility 2017; Index Fungorum 2017). The specimens are deposited in the Uludag University Mycology Laboratory, Bursa, Turkey (UUML), and in Mohamed Seifou Youssouf's personal collection (MSY). Collections are cited using the collector initials (Mohamed Seifou [Youssouf] = MS), date (month, day, year), and number of collections. A map of the area, a climate diagram, and climatic data covering average temperature and precipitation in the study area from 2010 to 2016 are presented in Plates 1 and 2 and Table 1.

Table 1. Climate data* for Comoros Island localities

Localities	Precipitation (mm)	Temperature (°c)
Bibavou	116	27
Ipvembeni	118	25
Moroni	234	26
M'vouni	232	25
Ntsorale	57	26
Sambamadi	56	27

*Source: National Civil Aviation and Meteorological Agency of Comoros

Results & discussion

This first study of myxomycetes from Comoros revealed three families (*Arcyriaceae, Didymiaceae, Physaraceae*), five genera (*Arcyria, Badhamia, Diderma, Didymium, Physarum*), and ten species, all new records for the country. Nine species are also known from elsewhere in Africa.

Moist chamber cultures prepared with samples from *Artocarpus altilis, Artocarpus heterophyllus, Carica papaya, Litchi sinensis, Pterocarpus indicus,* and *Ricinus communis* were positive, but some materials from rotting wood of *Cocos nucifera,* from litter and twigs of *Terminalia catappa,* from rabbit dung were invaded by filamentous molds during incubation, and no species of myxomycetes species were obtained.

All myxomycete collections recorded in our study are listed below alphabetically according to genus and species. The abbreviation "cf." after *Badhamia affinis* indicates that the specimen could not be identified with certainty.

Species

Arcyria insignis Kalchbr. & Cook, Grevillea 10: 143 (1882) Pl. 3

Sporocarps gregarious or bundle or sometimes scattered, bright rose or pale rose usually with an orange color 0.5–1.5(–3) mm tall, short-stalked sporangia. Hypothallus inconspicuous. Stalk <0.2-0.7 mm high, reddish-orange, filled with subglobose or spore-like cells. Peridium remaining as shallow, saucer-shaped cup, radially wrinkled, the inner surface warted, often in a network. Capillitium of pale yellow to colourless close network of soft threads, meticulously attached to the calyculus, marked with rings and half rings, in part meticulously spinulose to nearly smooth and occasionally with a few bulbous free ends, 2–3µm diameter. Spores pinkish in mass, colorless in transmitted light, with scattered inconspicuous warts, 6–8µm diam. Plasmodium whitish.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Moroni city,** vegetable garden: 11°43.26′S 43°15.12′E, 34 m elev., on *Artocarpus heterophyllus* debris, 16.09.2016, Mohamed Seifou (MSY 160916-01a).

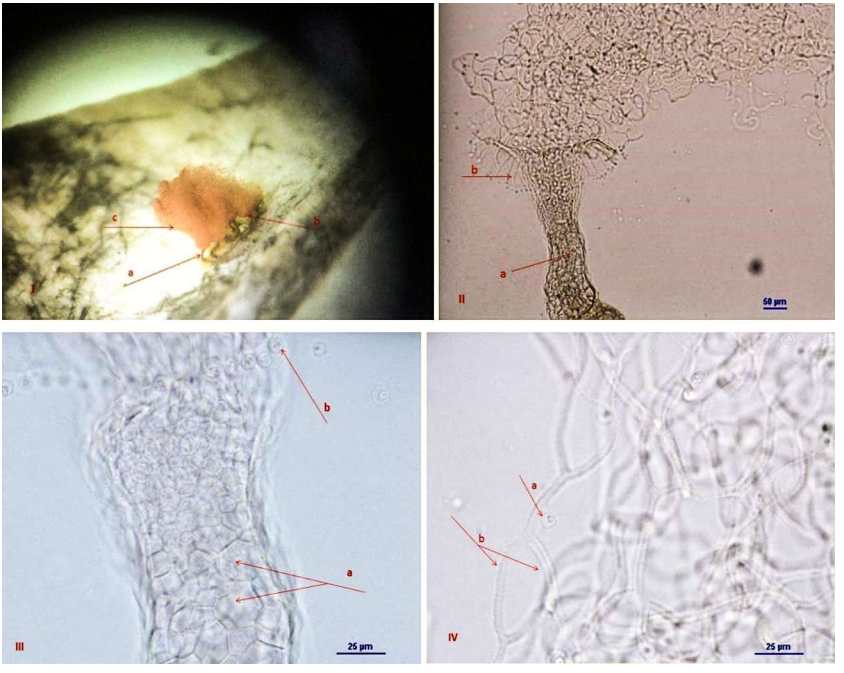

Plate 3. *Arcyria insignis* (MSY 160916-01a).
I- sporangium; a. stalk, b. calyculus, c. peridium; II- a. spore like-cells, b. calyculus; III- a. spore like-cells, b. spores; IV- a. capillitium, b. spores.

Comments—*Arcyria insignis* is considered cosmopolitan (Martin & Alexopoulos 1969, Lakhanpal & Mukerji 1981) and has been reported previously from Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

Badhamia cf. ***affinis*** Rostaf., Śluzowce Monogr.: 143 (1874) Pl. 4

Fructification gregarious, imbricate, depressed in the center and doughnut-shaped, blackish, mucilaginous, devoid of lime deposit. Hypothallus and stalk not observed. Peridium single and membranous, rugulose, translucent, minutely covered with aggregate material. Capillitial tubules conical, spike-like and smooth, not interconnected, sometimes bifurcate on the base and pointed end, radiating from a sponge-like plate and not reach for connecting to peridium, brownish, lime granules were not observed. Spores globose-subglobose, verruculose with wart cluster, free, brown in transmitted light, 12–14(–15) µm diameter.

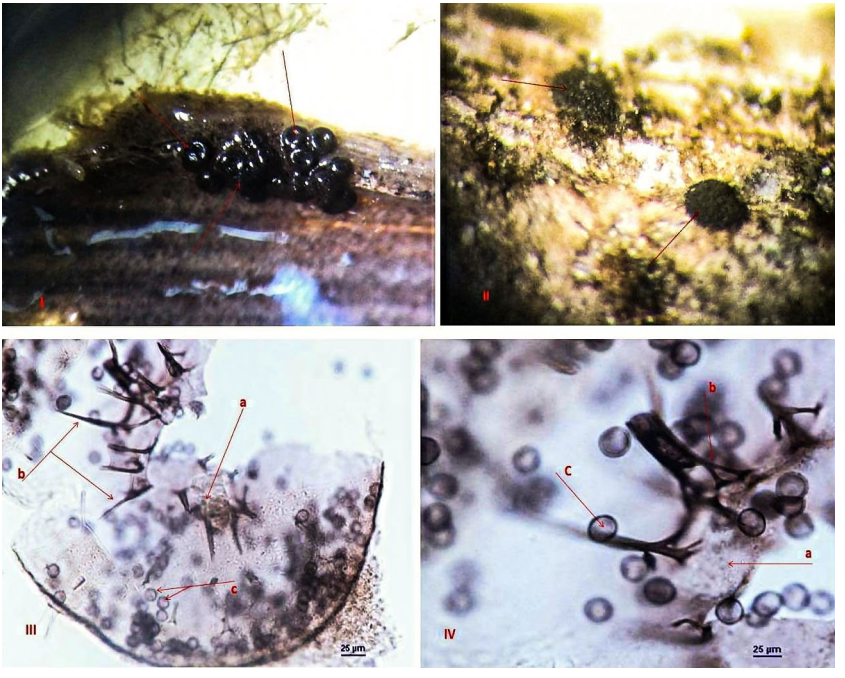

Plate 4. *Badhamia* cf. *affinis* (MSY 160916-01b).
I- sporocarps; II- dry sporocarps; III- a. sponge-like plate, b. capillitial tubules, c. spores; IV- a. sponge-like plate, b. capillitial tubule with a forked base.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Moroni city,** vegetable garden: 11°43.26′S 43°15.12′E, 34 m elev., on *Artocarpus heterophyllus* debris, 16.09.2016, Mohamed Seifou (MSY 160916-01b).

Comments—This species shares some similarities with other species such as *Badhamia affinis, Badhamia armillata,* and *Badhamiopsis ainoae.,* Differences are outlined below.

—In *Badhamia affinis,* the capillitial tubes are filled with white lime and the spores are densely spinulose (Ing 1999, Martin & Alexopoulos 1969, Nannenga-Bremekamp 1991). These characters were not observed in our specimen.

—In *Badhamia armillata,* the capillitial tubes are also filled with white lime, but its spores are large (–15)17–18 (–19) µm with a distinct pale line and densely covered with dark wartlets (Nannenga-Bremekamp 1991).

—In *Badhamiopsis ainoae,* the capillitial tubes rise from base to peridium, and the spores are smaller (9–10 µm; Ing 1999, Martin & Alexopoulos 1969, Discover Life 2017).

Diderma deplanatum Fries, Syst. Myc. 3: 110 (1829) Pl. 5

Fructification short plasmodiocarps (curved or ring-shaped) or sessile sporangia, scattered, pulvinate, white or pale cream-colored, 1–1.5 mm diam. Hypothallus inconspicuous. Peridium double, the outer layer smooth, crustose, brittle, thick, white, the inner layer membranous, iridescent, orange below. Columella absent, represented by the thickened orange-brown base of the sporocarp. Capillitium made up of dark purple threads, which are simple or sparsely dichotomously branched, with a few and small dark bead-like thickenings. Spores in mass dark brown, yellow-brown in transmitted light, minutely spinulose, 9–11µm diam.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Moroni city,** vegetable garden: 11°43.26′S 43°15.12′E, 34 m elev., on *Artocarpus heterophyllus* debris, 16.09.2016, Mohamed Seifou (MSY 160916-01c).

Comments—*Diderma deplanatum* has been found in Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017). This species resembles *D. effusum,* which is separated by the presence of a distinct columella, at least when forming sporangia or short plasmodiocarps. *Diderma deplanatum* was at one time included in *D. niveum* as a lowland form, but *D. niveum* has a well-developed columella, is sporangiate, and is not flattened; only the orange colored inner layer is shared by both species (Ing 1999). *Diderma deplanatum* is distinguished from *D. platycarpum*

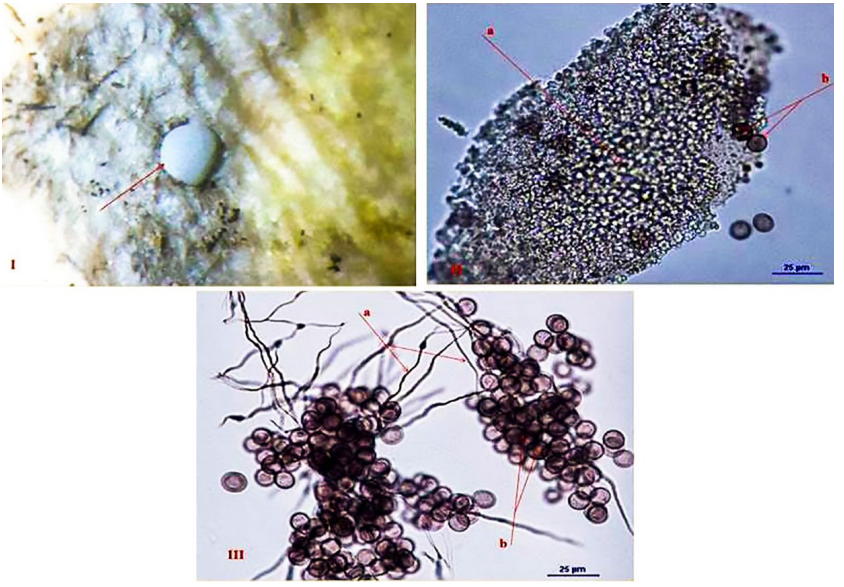

Plate 5. *Diderma deplanatum* (MSY 160916-01c).
I- individual sporocarp; II- a. peridium, b. spores; III- a. capillitial threads and spores.

by its less flattened plasmodiocarps that are simple or reticulate and not or only slightly plate-like, and its darker spores (Nannenga-Bremekamp 1991).

Didymium anellus Morgan, J. Cincinnati Soc. Nat. Hist. 16: 148 (1894) Pl. 6

Sporocarps plasmodiocarpic, perhaps broad or ring-shaped, sometimes sporangiate on a constricted base, infrequently short-stalked, varying to flat pulvinate, annulate, crustose, the surface pitted, white, or dingy gray to dark metallic. Hypothallus delicate, inconspicuous. Peridium single, membranous, purplish-brown, iridescent, covered with a rather sparse layer of lime crystals, dehiscence circumscissile. Columella absent or only suggested by an ochraceous or brownish deposit at the sporocarp base. Capillitium abundant, branched, and anastomosing slender dark threads that form an elastic net. Spores dark brown in mass, violet-brown in transmitted light, minutely warted (some warts found in clusters), 7–9 µm diam. Plasmodium transparent and colorless.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Bibavou city,** vegetable garden: 11°34.58′S 43°17.15′E, 194 m elev., on *Carica papaya* litter materials, 16.09.2016, Mohamed Seifou (MSY160916-06).

Plate 6. *Didymium anellus* (MSY160916-06).
I- plasmodiocarps; II- mature plasmodiocarps covered with white lime crystals;
III- a. peridium, b. crystals, c. capillitium, d. spores.

Comments—*Didymium anellus* has been reported from Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

Didymium minus (A. Lister) Morgan,
J. Cincinnati Soc. Nat. Hist. 16: 145 (1894) Pl. 7

Fructification, short-stalked sporangia, 0.8–1 mm tall, gregarious, depressed-globose or hemispherical, umbilicate below, white or pale gray, 0.4–0.6 mm diam. Hypothallus membranous, dark, usually forming disks under the sporangia. Stalk rather slender, faintly striate, partly submerged in the umbilicus, blackish or dark brown. Peridium membranous, delicate, covered with stellate lime crystals. Columella globose or depressed-globose,

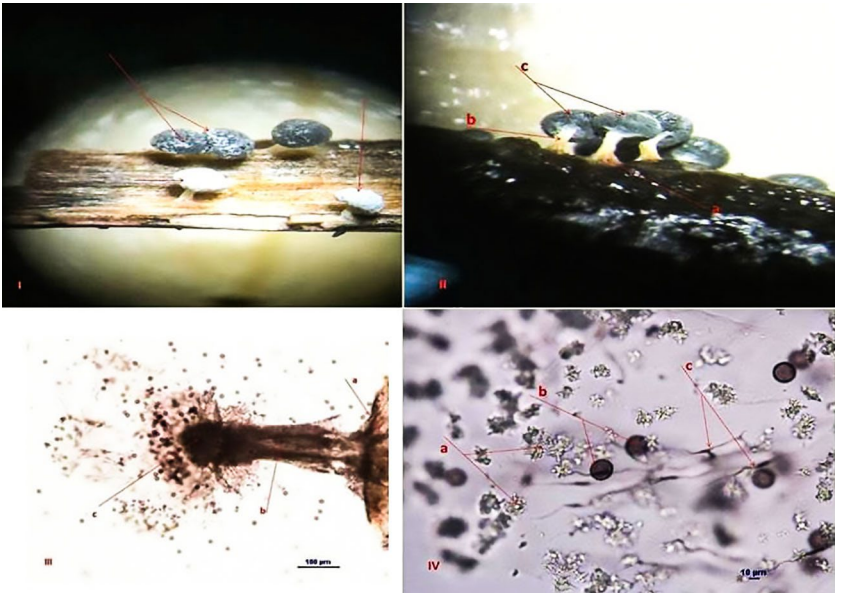

Plate 7. *Didymium minus* (MSY160916-02).
I- sporangium; II- a. hypothallus, b. stalk, c. peridium; III- a. hypothallus, b. stalk, c. columella; IV- a. crystals, b. capillitial threads, c. spores.

dark brown to sordid whitish, sometimes containing white crystalline lime. Capillitium delicate, colorless to lilac-grey, branching with few anastomoses. Spores dark brown in mass, dark violaceous brown by transmitted light, minutely warted, the warts often in groups, 8–12 µm diam. Plasmodium dark purplish-grey.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Moroni city,** vegetable garden: 11°43.26′S 43°15.13′E, 36 m elev., on *Artocarpus altilis* litter material, 16.09.2016, Mohamed Seifou (MSY160916-02).

Comments—*Didymium minus* considered cosmopolitan (Ing 1999, Martin & Alexopoulos 1969, Lakhanpal & Mukerji 1981) and has been reported in Africa (Ndiritu & al. 2009, Discover Life 2017).

Didymium minus is separated from *D. melanospermum* by its smaller size and smaller paler spores and from *D. nigripes* by the short stalk (Ing 1999, Martin & Alexopoulos 1969, Nannenga-Bremekamp 1991).

Didymium nigripes (Link) Fries, Syst. Myc. 3: 119 (1829) Pl. 8

Fructifications sporangiate with a long stalk <1.5 mm long, globose or subglobose, umbilicate below, white or ashy-grey, 0.3–0.5 mm diam. Hypothallus

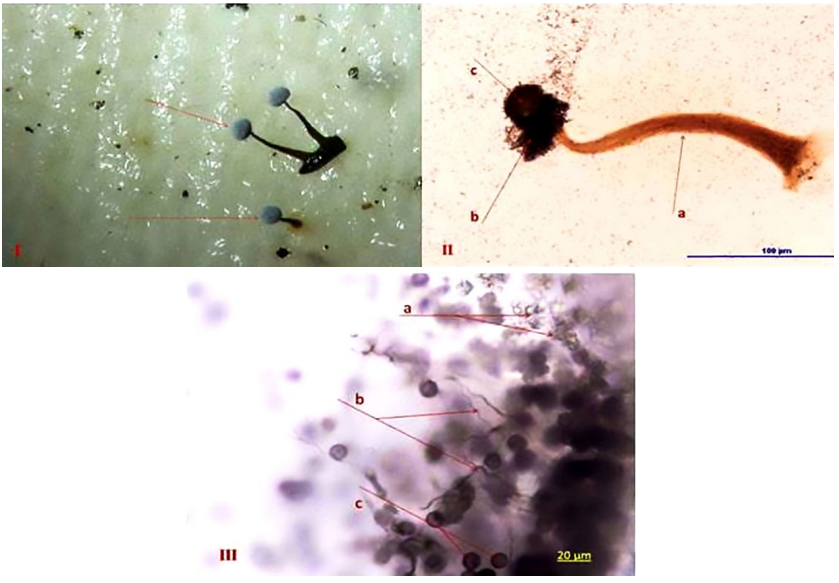

Plate 8. *Didymium nigripes*. (MSY 160916-07).
I- sporangium; II- a. stalk, b. spore mass, c. columella;
III- a. peridial crystals, b. capillitial threads, c. spores.

discoid, dark or blackish. Stalk slender, dark brown to blackish, slightly paler or red-brown towards the top, translucent red-brown in transmitted light, often filled with dark amorphous matter below. Peridium single, membranous, grey-brown, covered with white stellate lime crystals. Columella subglobose, dark brown, calcareous. Capillitium delicate, pale brown or colorless, sparsely dichotomously branched. Spores dark brown in mass, pale violaceous brown in transmitted light, minutely warted and the warts arranged in clusters, 7–9 µm diam. Plasmodium brown-grey or colourless

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Bibavou city,** vegetable garden: 11°34.594′S 43°17.154′E, 195 m elev., on *Pterocarpus indicus* debris, 16.09.2016, Mohamed Seifou (MSY 160916-07).

Comments—*Didymium nigripes* is regarded as cosmopolitan (Ing 1999, Martin & Alexopoulos 1969, Lakhanpal & Mukerji 1981) and has been previously recorded from Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

Didymium nigripes can be distinguished from *D. minus* by its thinner, longer, and mostly translucent stalk (Nannenga-Bremekamp 1991) and from *D. iridis* by its mottled peridium (Ing 1999).

Didymium serpula Fries, Syst. Myc. 3: 126 (1829) Pl. 9

Fructifications plasmodiocarps, solitary or in small groups, sessile, effused, perforated or nearly continuous, 0.1–0.15 mm thick, 2–8 mm long (sometimes much longer, ≤4 cm), dark grey or greyish-white. Hypothallus inconspicuous. Peridium membranous, dark grey or iridescent, sparsely to densely covered with stellate or irregular white lime crystals. Columella absent. Capillitium thin, dichotomously branched, with few or many anastomoses, yellow-brown or pale threads attached to a subglobose vesicle 30–50 µm diam. filled with yellow granular material. Spores brown in mass, pale violaceous brown or pale brown in transmitted light, covered with very fine warts, 7–9 µm diam.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Moroni city,** vegetable garden: 11°43.26′S 43°15.12′E, 34 m elev., on *Artocarpus heterophyllus* debris, 16.09.2016, Mohamed Seifou (MSY 160916).

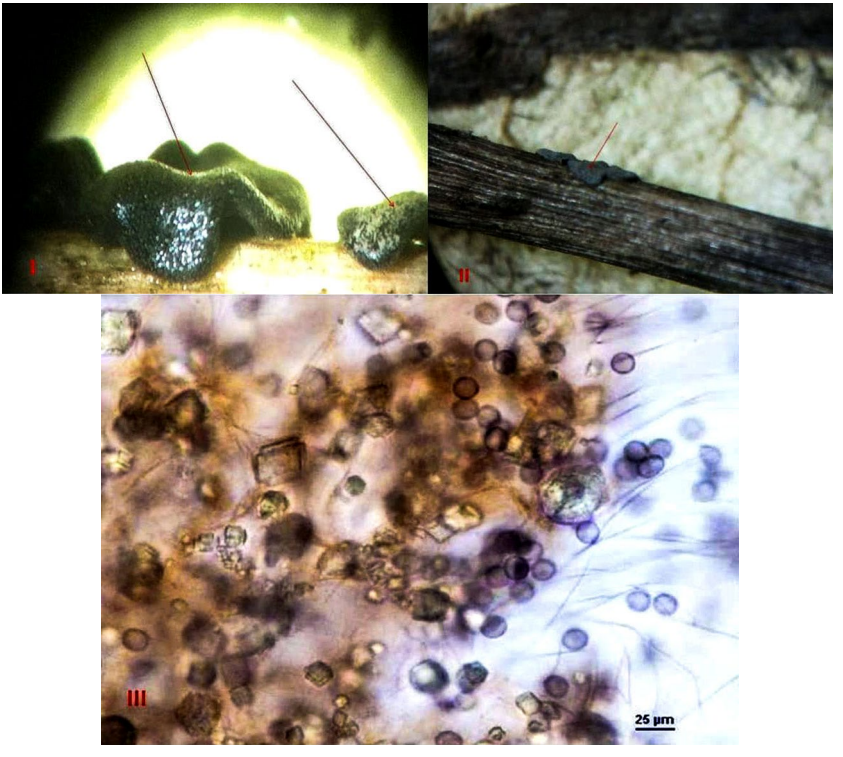

Plate 9. *Didymium serpula* (MSY 160916).
I- plasmodiocarps; II- plasmodiocarp covered with lime;
III- crystals (stellate or irregular), capillitial threads and spores.

Comments—*Didymium serpula* has been reported from Africa (Ndiritu & al. 2009, Ing 1999, Discover Life 2017).

Didymium serpula is distinguished from *D. flexuosum* Yamashiro, which produces capillitium that are not attached to the vesicle and differently shaped fructifications (Nannenga-Bremekamp 1991).

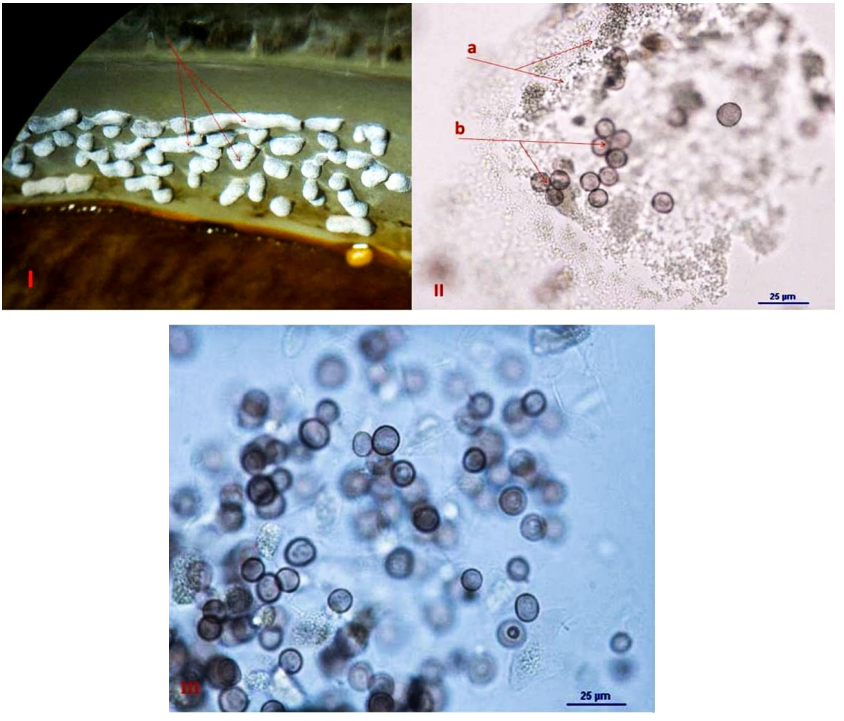

Plate 10. *Physarum cinereum* (MSY 160917-05a).
I- plasmodiocarps; II- a. peridium, b. spores; III- capillitium and spores.

Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1: 89 (1794) Pl. 10

Fructifications sessile sporangiate, subglobose or short to elongated plasmodiocarps, closely gregarious, crowded or heaped, 0.3–0.5 mm broad, ash-grey or white (occasionally iridescent from lack of lime). Hypothallus inconspicuous and colourless. Peridium single, membranous, colorless or pale brown, encrusted with a more-or-less white lime deposit. Columella absent. Capillitium abundant, with spherical or angular large white nodes, hyaline or with calcareous deposit, sometimes almost badhamioid. Spores purplish-brown in mass, clear violaceous in transmitted light, minutely

warted, 9–13 µm diam. Plasmodium watery-white or colorless, often becoming bright

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Ntsorale city,** edge of the road: 11°41.227′S 43°24.768′E, 243 m elev., on *Ricinus communis* aerial and litter materials, 17.09.2016, Mohamed Seifou (MSY 160917-05a).

Comments—*Physarum cinereum* is regarded as cosmopolitan (Martin & Alexopoulos 1969, Ing 1999, Lakhanpal & Mukerji 1981) and has been reported from Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

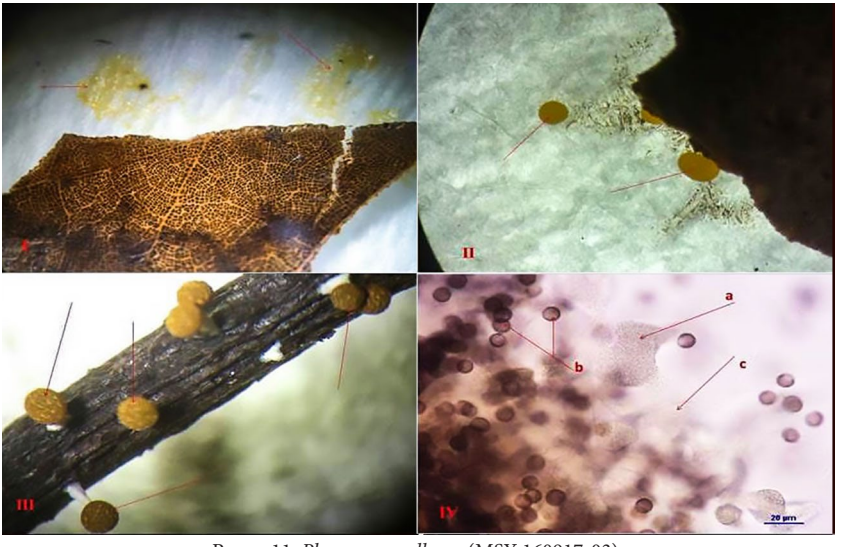

Plate 11. *Physarum melleum* (MSY 160917-03).
I- plasmodium; II- sclerotium; III- sporangia; IV- capillitium and spores.

Physarum melleum (Berk. & Broome) Massee,
Monogr. Myxogastr.: 278 (1892) Pl. 11

Fructifications sporangiate, gregarious, stipitate, rarely sessile, mostly globose, 0.4–0.5 mm diam., frequently yellow to dull orange, but varying from yellowish grey or honey yellow to bright orange-red or reddish brown. Hypothallus white or colorless. Stalk small (≤50% of the total height of the sporangium), cylindrical or tapering upward, stout, opaque, white, sometimes ochraceous or tawny, furrowed, calcareous. Peridium single, rugose, persistent at the base, encrusted with lime. Columella small, calcareous, conical, color white, yellowish, pallid, rarely orange. Capillitium abundant, the nodes large, angular, white (less commonly yellow or orange),

internodes small and delicate. Spores globose, dark brown in mass, pale violet-brown in transmitted light, minutely warted, 7.5–9 µm diam. Plasmodium yellow or olive-green.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, M'vouni city,** vegetable garden: 11°43.27′S, 43°16.54′E, 395 m elev., on *Litchi sinensis* aerial and litter materials, 17.09.2016, Mohamed Seifou (MSY160917-03).

Comments—*Physarum melleum* is regarded as cosmopolitan (Lakhanpal & Mukerji 1981, Martin & Alexopoulos 1969) and has been reported previously from Africa (Ndiritu et al 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

Physarum notabile T. Macbr., N. Amer. Slime-Moulds ed. 2: 80 (1922) Pl. 12

Fructification sporangiate, stalked, occasionally sessile, up to 1,5 mm in length or forming short plasmodiocarps, gregarious, globose to kidney-shaped,

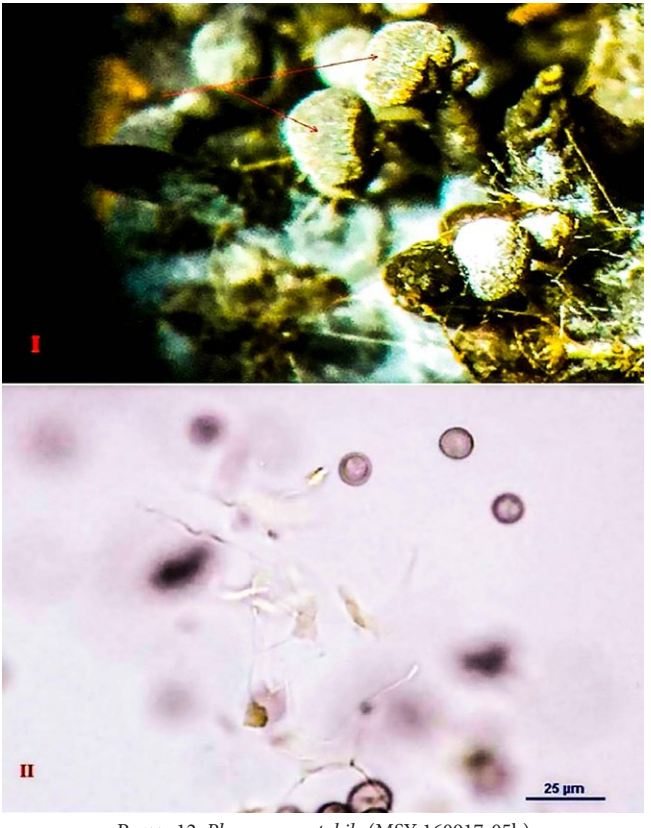

Plate 12. *Physarum notabile* (MSY 160917-05b).
I- sporangium; II- capillitium and spores.

white, 0.3–1 mm diam. Hypothallus concolorous with the stalk. Stalk (when present) short, weak to stout, tapering upward, plicate-furrowed, opaque, dark or covered with white calcareous granules. Peridium single, membranous, densely covered with ashy white calcareous deposit, the basal peridium persisting as a broad cup. Columella absent. Capillitium abundant, nodes variable in size and shape, connected by long hyaline threads. Spores black in mass, olivaceous brown in transmitted light, minutely warted, 9–12 µm diam.

Specimen examined—**COMOROS ISLANDS, Ngazidja Island, Ntsorale city,** edge of the road: 11°41.23′S 43°24.77′E, 243 m elev., on *Ricinus communis* aerial and litter materials, 17.09.2016, Mohamed Seifou (MSY 160917-05b).

Comments—*Physarum notabile* has been collected previously in Africa (Ndiritu & al. 2009, Wrigley de Basanta & al. 2013, Discover Life 2017).

The sessile or plasmodiocarpous forms may be mistaken for forms of *P. compressum* with much darker spores, so it is very important to check the spore colour carefully (Ing 1999).

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Literature cited

Bachèlery P, Lenat JF, Di Muro A, Michon L (eds). 2016. Active volcanoes of the southwest Indian Ocean: Piton de la Fournaise and Karthala. Springer. 428 p. https://doi.org/10.1007/978-3-642-31395-0

Capaustral. 2017 [continuously updated; viewed online in February 2017]. Capaustral 250 pays et térritoires à visiter. comores. http://www.capaustral.com/climat-meteo-comores.php

Central Intelligence Agency. 2017 [continuously updated]. The World FactBook. Comoros. https://www.cia.gov/library/publications/the-world-factbook/geos/cn.html#People [viewed online in February 2017]

Discover Life. 2017 [continuously updated]. http://www.discoverlife.org/ [viewed online in February 2017.]

Emerick CM, Duncan RA. 1982. Age progressive volcanism in the Comores Archipelago, western Indian Ocean and implications for Somali plate tectonics. Earth and Planetary Science Letters 60: 415–428. https://doi.org/10.1016/0012-821X(82)90077-2

Emerick CM, Duncan RA. 1983. Age progressive volcanism in the Comores Archipelago, western Indian Ocean and implications for Somali plate tectonics. Errata. Earth and Planetary Sciences Letters 62: 439.

Esson J, Flower MFJ, Strong DF, Upton BGJ. 1970. The geology of the Comores Archipelago, western Indian Ocean. Geological Magazine 107: 549–557.

Farr ML.1976. Myxomycetes. Flora Neotropica 16. 304 p.

Farr ML. 1981. How to know the true slime molds. The pictured key Nature Series, Wm. C. Brown company publishers, Dubuque, Iowa. 144 p.

Flower MFJ. 1973. Petrology of volcanic rocks from Anjouan, Comores Archipelago. Bulletin of Volcanology 36: 238–250.

Global Biodiversity Information Facility. 2017 [continuously updated; viewed online in March 2017]. http://www.gbif.org/

Index Fungorum. 2017. http://www.indexfungorum.org/ [continuously updated; viewed online in March 2017]

Ing B. 1999. The myxomycetes of Britain and Ireland: an identification handbook. The Richmond Publishing Co. Ltd. England.

Lado C. 2001. Nomenmyx: a nomenclatural taxabase of myxomycetes. Cuadernos de Trabajo de Flora Micológica Ibérica 16.

Lado C, Pando F. 1997. Flora Mycologica Iberica. Vol. 2. CSIC, Madrid, Spain.

Lakhanpal TN, Mukerji KG. 1981.Taxonomy of the İndian myxomycetes. J. Cramer, Vaduz.

Martin GW, Alexopoulos CJ. 1969. The myxomycetes. University of Iowa Press. Iowa City. 560 p.

Martin GW, Alexopoulos CJ, Farr ML. 1983. The genera of myxomycetes. Iowa City. 561 pp.

Nannenga-Bremekamp NE.1991. A guide to temperate myxomycetes. Biopress Limited, Bristol. 409 p.

Ndiritu G, de Haan M. 2014. More additions to the checklist of African myxomycetes. Poster: 8th International Congress on Systematics and Ecology of Myxomycetes. China. https://doi.org/10.13140/RG.2.1.2236.2480

Ndiritu GG, Winsett KE, Spiegel FW, Stephenson SL. 2009. A checklist of African myxomycetes. Summary published in Mycotaxon 107: 353–356. [Downloaded January 2017: http://www.mycotaxon.com/resources/checklists/ndiritu_v107-checklist.pdf]

Nougier J, Cantagrel JM, Karche JP. 1986. The Comores archipelago in the western Indian Ocean: volcanology, geochronology and geodynamic setting. Journal of African Earth Sciences 5: 135–145. https://doi.org/10.1016/0899-5362(86)90003-5

Olson DM, Dinerstein E. 2002. The Global 200: priority ecoregions for global conservation. Annals of the Missouri Botanical Garden 89: 199–224. https://doi.org/10.2307/3298564

Singaomara. 2017 [continuously updated; viewed online in February 2017]. http://www.singaomara.com/rephistoires/histoiresComores.html

Späth A, Le Roex AP, Duncan RA. 1996. The geochemistry of lavas from the Comores Archipelago, western Indian Ocean: petrogenesis and mantle source region characteristics. Journal of Petrology 37: 961–991. https://doi.org/10.1093/petrology/37.4.961

Stephenson SL. 2011. From morphological to molecular: studies of myxomycetes since the publication of the Martin and Alexopoulos (1969) monograph. Fungal Diversity 50: 21–34. https://doi.org/10.1007/s13225-011-0113-1

Stephenson SL, Stempen H. 1994. Myxomycetes: a handbook of slime molds. Timber Press: Portland, Oregon USA. 200 p.

Thind KS. 1977. The myxomycetes of İndia. ICAR, New Delhi. 252 p.

Voeltzkow A. 1917. Flora und fauna der Komoren. Reise in Ostafrika in den Jahren 1903–1905 3: 429–480.

Wikipedia 2017a. https://fr.wikipedia.org/wiki/Flore_des_Comores [continuously updated; viewed online February 2017].

Wikipedia 2017b. https://fr.wikipedia.org/wiki/Grande_Comore [continuously updated; viewed online February 2017].

Wrigley de Basanta D, Lado C, Estrada-Torres A, Stephenson SL. 2013. Biodiversity studies of myxomycetes in Madagascar. Fungal Diversity 59: 55–83. https://doi.org/10.1007/s13225-012-0183-8